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Adrian Jefferson
Contract Monitor
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Code 216
Greenbelt, MD 20771

**Final Report for
NASA Grant NAG5-4115**

Dear Ms Jefferson:

During the period 15 April, 1997 through 15 April, 2000 we have been supported in part by NASA grant **NAG5-4115** to pursue a "Search for the Centrifugal Barrier in Transient X-ray Pulsars" with RXTE. The RXTE observations associated with this research involved monitoring the X-ray intensities and pulse profiles of six transient X-ray pulsars on five different occasions. The goal was to determine whether the so-called "centrifugal barrier" effect exists for accretion-powered X-ray pulsars. In this long-postulated effect, accretion onto the neutron star should be inhibited when the accretion rate falls below the point where the magnetospheric boundary lies outside the neutron star's corotation radius.

Data from 6 accretion-powered X-ray pulsars were obtained on 5 different occasions for each pulsar. The objects observed with RXTE included: 4U 0115+63 ($P = 3.61$ sec); V0332+53 ($P = 4.37$ sec); 2S 1553-542 ($P = 9.27$ sec); 2S 1417-62 ($P = 17.6$ sec); OAO 1657-415 ($P = 37.3$ sec); and GRO J1008-57 ($P = 93.5$ sec). For four of these sources (4U 0115+63, V 0332+53, 2S 1417-62, and GRO J1008-57) no X-ray pulsations could be detected down to the limits of typical 5000-sec RXTE observations. A fifth source, OAO 1657-415, was detected in a bright state during all five observations. This source is now understood to be a steady X-ray source, which is inappropriate for studying a possible centrifugal barrier effect. Finally, pulsations from 2S 1553-542 were detected during 3 of the 5 observations. Since two of the three positive detections occurred when the X-ray intensity was very near the detection threshold, we are unable to use these data to constrain possible models for the centrifugal barrier.

Our RXTE observations yielded detections of two of the six X-ray pulsars under study, but were insufficient, overall, to yield any new insight into the centrifugal barrier effect. The data from the two detected pulsars will be utilized by Professor Deepto Chakrabarty as part of his overall campaign to study the long-term behavior of accretion-powered X-ray sources.

Sincerely,

Saul Rappaport

Saul Rappaport
Professor of Physics